

**TECHNOLOGY AS A NEW LEARNING
AREA IN THE SOUTH AFRICAN SCHOOL**

**CURRICULUM:
A CRITICAL REFLECTION**

BY

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DECLARATION

I, the undersigned hereby declare that the work contained in this thesis is my original work and has previously, in its entirety, or in part not been submitted at any university for a degree.

SIGNATURE

DATE

ABSTRACT

This thesis investigates the implementation of Technology as a learning area in the South African school curriculum. This investigation is done within the context of three articles contained in chapters two, three and four.

Article one, chapter two, investigates the readiness of educators to implement Technology in the classroom. A survey was done by means of interviews and a questionnaire. The interviews and questionnaire focused on three critical questions to determine the readiness of educators, namely

- A conceptual understanding of Technology as learning area;
- The type of technology suitable for the South African curriculum; and
- The extent of government support to implement Technology successfully.

The findings suggest that educators do have a conceptual understanding of Technology and that they emphasized the use of technology within the curriculum that suits local conditions. It identified the lack of government support as the biggest problem facing the successful implementation of Technology.

Article two, chapter 3, investigates Technology as part of the Outcomes- Based Curriculum 2005. It is a theoretical study that discuss the relevance and purpose of Technology as learning area in the new curriculum.

It finds that the position of Technology as learning area in the curriculum is unequivocal. It proved that there is a strong link between technological innovation, economic growth and social development. It suggest, therefor, that Technology is a catalyst for economic growth and social development.

Article three, chapter four, invetsigates how Technical Drawing as subject from the old dispensation can be reconciled with Technology as a learning area.

It finds that Technical Drawing as a graphical language can be applied as an effective tool of communication in the different stages of the Technological Process. It suggests that the old subjects can reconcile with the learning areas in the new curriculum.

These three articles, in summary, emphasize the importance and relevance of Technology as a separate learning area in the new curriculum. The objective, therefore, is to use Technology as a catalyst for economic growth and social development, so dearly needed by South Africa.

OPSOMMING

Hierdie tesis ondersoek die implementering van Tegnologie as 'n leerarea in die skoolkurrikulum. Hierdie ondersoek word binne die konteks van drie artikels wat in hoofstukke twee, drie en vier vervat word, gedoen

Artikel een (hoofstuk twee), ondersoek die gereedheid van opvoeders om Tegnologie in die klaskamer toe te pas. 'n Opname is deur middel van onderhoude en 'n vraelys gedoen. Ten einde die gereedheid van opvoeders te bepaal, is daar in die onderhoude en vraelys op drie kritieke vrae gefokus:

- 'n konseptuele begrip van Tegnologie as 'n leerarea;
- die soort tegnologie wat relevant sou wees binne die Suid-Afrikaanse kurrikulum; en
- die mate van regeringshulp wat nodig sou wees om Tegnologie suksesvol as leerarea te implementeer.

Die bevindinge dui daarop dat opvoeders wel 'n konseptuele begrip van Tegnologie het. Dit blyk voorts dat opvoeders die gebruik binne die kurrikulum beklemtoon van tegnologie wat by plaaslike omstandighede pas. Gebrekkige regeringshulp is as die grootste probleem rakende die suksesvolle implementering van Tegnologie as leerarea geïdentifiseer.

Artikel twee (hoofstuk drie) ondersoek Tegnologie as deel van die Uitkomsgebaseerde Kurrikulum 2005. Dit is 'n teoretiese studie wat die toepaslikheid en doel van Tegnologie as leerarea in die nuwe kurrikulum bespreek.

Daar word bevind dat die plek van Tegnologie as leerarea in die kurrikulum ondubbelsinnig is. Daar is bewys dat daar 'n sterk band bestaan tussen tegnologiese vernuwing, ekonomiese groei en sosiale ontwikkeling.

Artikel drie (hoofstuk vier) ondersoek hoe Tegniese Tekene as "ou" vak van die vorige bedeling, met Tegnologie as leerarea versoen kan word.

Daar word bevind dat Tegniese Tekene, as 'n grafiese taal, aangewend kan word as 'n doeltreffende kommunikasiemiddel in die verskillende stadia van die Tegnologiese Proses. Daar word voorgestel dat die ou vakke versoen kan word met die leerareas in die nuwe kurrikulum.

Hierdie drie artikels beklemtoon dus die belangrikheid en relevansie van Tegnologie as 'n aparte leerarea in die nuwe kurrikulum. Die doel is om Tegnologie aan te wend as katalisator vir ekonomiese groei en sosiale ontwikkeling wat so dringend nodig is in Suid-Afrika.

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CHAPTER 1: INTRODUCTION AND ORIENTATION

1.1 INTRODUCTION

South Africa has, for decades, been used to a dichotomy in education (Pretorius, 1998:vi). A certain minority group received education of a standard comparable to that of the most developed and well-provided education systems in the world, whilst others were subject to educational circumstances comparable to those of the most impoverished on the African continent. As a result millions of adults in the country are functionally illiterate.

The concern for an education system in crisis was raised by numerous individuals and at different forums. A discussion document, *A Policy Framework for Education and Training*, identifies three key problem features of the system, namely that it is too fragmented, that there is a lack of access or unequal access, and that there is not sufficient democracy within the system. A Framework Report for Transformation by the National Commission on Higher Education (NCHE) (DoE, 1996c: 1) highlights " the profound deficiencies of the present system which inhibit its ability to meet the moral, social, and economic demands of the new South Africa". Kellerman (1995) emphasizes the inadequacies of the education system in terms of accommodation and relevance. In his keynote address at the Community Education conference in Johannesburg (1995), Professor Sibusiso Bengu stated that the conventional organization of primary, secondary and tertiary education no longer meets our society needs.

The birth of the new South Africa in 1994 added another dimension to an education system already in crisis. South Africa became part of the global village, which includes the challenges associated with that membership, i.e. an ever-increasing competitive economic global environment, a world that is an ever-changing place, politically, geographically and technologically (South African Qualifications Authority, 2001:3).

The inevitability of a new education system is obvious. South Africa, in essence, needed an education system that is able to deal with the problems of the past and faces the challenges of the new. Successful modern economies and societies require citizens with a strong foundation on general education, the desire and ability to continue to learn, to adapt to and develop new knowledge, skills, and technologies, to move flexibly between occupation, to take responsibility for personal performance, to set and achieve high standards, and to work co-operatively (Van Dyk, 1999:1).

The new government responded to these challenges with the introduction of a new outcomes-based approach towards education, which developed into a new Curriculum 2005. This new educational approach is a radical shift from the traditional one. An outcomes-based educational approach has at its core, the development of a learner's creative, critical thinking and problem solving-abilities. These qualities enhance the capacity for lifelong learning - a notion that all people must be enabled to develop their full potential through formal or informal schooling, which is an important prerequisite for social and economic upliftment so dearly needed in South Africa.

Chapter 3 will unpack the legislative structures, such as the South African Qualifications Authority (SAQA), the National Qualifications Framework (NQF), and show how the new Curriculum 2005 and eventually Technology 2005 tie in with these structures.

The new educational approach gave birth to Curriculum 2005. The primary function and goal of this new curriculum is to provide a framework for the implementation of outcomes-based education in the classroom. This curriculum consists of eight learning areas, namely Language, Literacy and Communication; Human and Social Sciences; Mathematical Literacy, Mathematics and Mathematical Sciences; Natural Sciences; Arts and Culture; Economic and Management Science; Life Orientation and Technology.

The significance of Technology as a learning area in the new curriculum, (amongst other factors), is based on the following:

1. The skill-acquiring, problem-solving, creative thinking, critical thinking and decision-making nature of Technology make it an ideal catalyst for social and economic upliftment.
2. It is consequently perceived to provide a 'short-cut' between the developed and the developing phases of the social and economic status of the nation.

3. The pursuit of technology literacy within the new curriculum for learners enhances the capacity for lifelong learning, which is central to the philosophy of Outcomes-Based Education.

These features are proof that Technology underscores the essence of Outcomes-Based Education. These developments prompted the National Department of Education to investigate the feasibility of implementing Technology in the schools. The Heads of Education Department Committee (HEDCOM) at national level initiated the Technology 2005 Pilot Project. This is an experimental research and development project, introduced in selected schools, to examine the feasibility of implementing Technology in schools on a broad scale. The primary focus was on developing a Technology curriculum and the supply of resources and the training (and retraining) of teachers. Provincial Task Teams, each consisting of two or three people, were set up. The ideal was to set up one Provincial Task Team for each of the nine provinces, but eventually only three (Kwa-Zulu Natal, Gauteng and the Western Cape) became operational.

The difficulty experienced in implementing Curriculum 2005 generally, and a Review Committee C2005 published in May 2000 specifically, also highlighted Technology. The implementation process was faced with enormous problems concerning financial, physical and human capacity. The most common problems experienced by teachers, according to the Report (4), are complaints of excessive paperwork, schools with poor infrastructure, large classes, an absence of the technologies of teaching, and a lack of educational resources such as textbooks, exercise books, pens and pencils.

This Report (45) also indicated practical problems experienced with the implementation of emergent learning areas such as Technology. Problems experienced were, amongst others, the lack of competent teachers, equipment and/or textbooks. A revised structure of the curriculum therefore excluded Technology as a separate learning area. The Review Committee (93) recommended that Technology (as applied science) be introduced in the learning area National Sciences and that 'design' features of Technology be included in the Life Orientation learning area. Technology, somehow, continued to exist as a separate learning area at this stage.

This overview on educational developments created the platform from which this portfolio will investigate the implementation of Technology as a learning area in the South African school curriculum.

1.2 PROBLEM STATEMENT

The introductory paragraphs indicated that there is much work to be done in order to secure the successful implementation of Technology as a learning area in the new school curriculum. Technology was implemented in 1998 (CENIS: 4) as a pilot in 20 schools in the Western Cape against the background of an education system that is still racist, sexist, authoritarian, prescriptive, unchanging, content bound and discriminatory. These conditions were compounded by the absence of curriculum content or learning programmes, a resource-poor school and class environment and the lack of properly trained teachers.

Within this context, this research portfolio, is a limited investigation into the implementation of Technology as a learning area in the new Outcomes-Based Curriculum 2005.

1.3 FOCUS

The aim of this portfolio is to focus on the implementation of Technology in the school curriculum.

It will do so by means of three reports, which deal with different aspects of Technology, which include the implementation thereof as the underlying focus. The individual focuses of these three reports include the readiness of teachers to implement Technology as a vehicle for social and economic upliftment, and the reconciliation between an existing subjects such as Technical Drawing with Technology as a new learning area.

The general question this portfolio wants to answer is whether educators are ready to implement Technology successfully.

1.4 METHODOLOGY

The first article is a survey by means of interviews and questionnaires with a view to investigate the readiness of educators to implement Technology in the new school curriculum.

Interviews were conducted with five individuals that have considerable knowledge of Technology. Two of them were affiliated to the ORT-STEP Institute and the remaining three form the Technology Task Team appointed by the Department of Education. These interviews were done

in order to evaluate their assessment of the implementation of Technology in the Western Cape pilot schools.

The question was faxed to the interviewees, prior to the actual interview. The interviews that were conducted with the ORT-STEP group took place at their premises in Mowbray. The interviews with the Technology Task Team were conducted at the Parow Teacher Centre as arranged. All the interviews were conducted in a friendly and relaxed, but committed atmosphere. The respondents were well prepared and extensive notes were taken to ensure that the data collected is credible and accurate.

A questionnaire was also distributed amongst the 20 pilot schools. This method was used to gain actual information at schools where Technology has been introduced as a pilot. This was also done to gather the information of the educator that deals with the situation in the classroom. The questionnaire ensured confidentiality and anonymity to the respondents, in order to gain honest and reliable responses from them.

The second article is a study of outcomes-based education as an approach, the new Curriculum 2005 that needs to facilitate that approach, Technology as a new learning area and the way in which it could enhance social and economic upliftment.

The third article is a study of how Technical Drawing and Technology can reconcile within the new curriculum. It will be possible to indicate in a practical manner how the old can blend with the new.

It can serve as an example to other of learning areas.

1.5 TERMINOLOGY

It is important to clarify, the following concepts in order to read the portfolio in its proper context:

1.5.1 **Curriculum 2005** is the new curriculum, which is essentially outcomes-based; the culmination of numerous attempts to create a curriculum conducive to social and economic development.

1.5.2 **Technology** is that process arising out of human needs and wants, that uses skill, knowledge, information and the manipulation of material such as wood, metal and textiles to manufacture a product for human use and benefit, with the objective of maintaining or improving the prevailing situation.

Rob Coppock (1984:7) refers to **technology**, in its broadest sense, as the sum of the means employed to create objects necessary for human sustenance and comfort. Thus, technology constitutes innovation by means of processes and products, for the purpose of human comfort and consumption.

1.5.3 **High technology** is a concept which is used in this article to mean those technologies that are highly sophisticated, in process as well as product, for example nuclear, space and satellite devices which are normally accessible only to a very few people.

- 1.5.4 **Low technology** is technology that has the potential to be accessible to more people, for example in manufacturing of food products and the use of agricultural products.
- 1.5.5 **Appropriate technology** is technology that best suits the needs and lifestyle of the people using it. The appropriateness of the technology refers to the context in which it is used i.e. a rural, semi-urban or urban community.

1.6 STRUCTURE AND OUTLINE

This research portfolio consists of five chapters.

Chapter 1 is an introduction to this research portfolio. It deals with the content, i.e. problem statement, aims and objectives and the broad outline of this study.

Chapter 2 consists of an investigation into the readiness of educators in selected schools in the Western Cape to implement Technology as a learning area.

Chapter 3 is an investigation into Technology Education as part of the Outcomes-Based Curriculum 2005.

Chapter 4 examines how Technical Drawing as an existing schoolsubject can be reconciled with Technology as a new learning area.

Chapter 5 deals with the general findings, conclusions and recommendations, reached within the previous chapters.

1.7 CONCLUSION

It is against this background of a changing educational environment in which Technology has to be implemented that the study was undertaken.

In Chapter 2 the investigation into the readiness of educators to implement Technology as learning area will be discussed.

REFERENCES

African National Congress (ANC). 1994. **ANC Discussion Document: A policy framework for education and training.** Braamfontein: ANC.

Community College Association of South Africa (CCASA). **Tele-conference between CCASA and the American Association of Community Colleges (AACC).** Conference report: 23 April 1995 (Unpublished).

Department of Education (DoE). 1996. National Commission on Higher Education (NCHE). Discussion document: **A Framework for Transformation.** Pretoria: Government Printers.

Kellerman, C.P.J. 1995. **'n Fundamenteel - opvoedkundige studie van die gemeenskap-kollegekonsep in Suid-Afrika.** Doctoral thesis, University of Stellenbosch (Unpublished).

Pretorius, P. (1998) **Outcomes-Based Education in South-Africa.** Goodwood, Cape Town: National Books Printers.

Ramphela, M. (2001). **The National Qualifications Framework (NQF) Report of the Review Committee on Curriculum 2005,** (31 May 2000) Pretoria.

Technology 2005: **A national Implementation Study (CENIS).**

Van Dyk, A. & Van Dyk. 1999. **Design and technology in the classroom today - The thinking teacher's guide.** Goodwood, Western Cape: Via Africa.

CHAPTER 2: A LIMITED INVESTIGATION INTO THE READINESS OF EDUCATORS IN SELECTED SCHOOLS IN THE WESTERN CAPE FOR IMPLEMENTING TECHNOLOGY AS A LEARNING AREA

2.1 INTRODUCTION AND METHODOLOGY

Chapter 2 is a description of the results of an empirical study into the implementation of Technology in the new Curriculum 2005. This chapter will investigate and report the readiness of selected educators to implement Technology as a learning area.

A survey was done by means of interviews and questionnaires. The use of interviews and questionnaires to collect data was chosen to give a comparative and broader view on the implementation of Technology in schools. This would ensure a high level of validity, and also reliability, of the study. High priority is put on integrity, objectivity and honesty in gathering the information by the researcher, which further elevates the reliability of this study.

Interviews were conducted with two trainers of the ORT–STEP Institute, a non-governmental organization dealing with the training of educators in Technology and Science related subjects, and three members of the Technology Task Team (TTT) appointed by the Department of Education. The TTT facilitated the implementation, monitoring and evaluation of the Technology learning area in 20 pilot schools.

The questionnaire was distributed to 20 schools within the Western Cape region. These schools were chosen to run a pilot project on the introduction of Technology in the schools. It consisted of 10 primary and 10 secondary schools.

The survey, which includes interviews and the above-mentioned questionnaire, deals with three fundamental issues, namely

1. The conceptual understanding of Technology by educators;
2. An understanding of Technology that is relevant to the South African context; and
3. The extent of government support with regard to resources such as equipment, accommodation, and teacher training and retraining.

These issues are important in determining the level of readiness of educators to implement Technology in schools successfully.

2.2 INTERVIEWS

2.2.1 Questions and results

A list of eight open-ended questions was compiled. It was sent to the respondents prior to the interview. The location, time and conditions of interviews are described in the methodology of this portfolio in chapter 1. These questions are not necessarily in sequence from 1-7, but are clustered in such a manner to get responses on the three fundamental issues mentioned in the introduction.

The interviews consist of the following:

Questions 1 and 2 deal with the conceptual understanding of technology as a general concept and Technology as a learning area.

They are:

- 1. Given your extensive involvement in Technology, what are your understanding of technology in general, and the importance of Technology in particular, within the context of South Africa?**
- 2. What is your view of the inclusion of Technology as a general compulsory learning area within the new curriculum?**

The data that follows represents the results of the respondents' answers.

The success of the implementation of Technology in the classroom is to a great extent dependent on the understanding of the concepts by the educators.

The respondents were able to identify the following key features of Technology in question 1:

- It is problem-solving in nature.

- It has four 'drivers', namely structures, systems, processing and communication.
- Technology is about capabilities, i.e. design, make, and evaluate.
- Technological literacy is of great importance.
- It can become a powerful vehicle for social change.

The respondents were not very clear in identifying the differences between the concept of Technology as a learning area and technology in general.

The inclusion of Technology as a learning area was the focus of question 2 and was viewed very positively:

- The inclusion of Technology brings learners nearer to real-life situations.
- It develops life skills in learners.
- Technology has a lot to offer.
- Technology involves a lot of hands-on activity.

The level of understanding of the nature of Technology education was clearly demonstrated by the respondents. The respondents also indicated that the inclusion of Technology in the school curriculum is a positive development.

Questions 3 and 7 focused on the particular type of Technology suitable for South Africa. (Relevant or appropriate Technology in the South African context).

- 3. It is taken that you have an understanding of concepts such as appropriate, low and high technologies. What type of technology, in your view, would best serve South Africa?**
- 7. Technology changes very rapidly, resulting in the shifting of the so-called goal posts. Do you think that technology is an appropriate vehicle to empower the masses of learners in the township schools, or at least to narrow the gap between the 'haves' and the 'have nots'?**

The following represent the results of the respondents' answers:

Another factor that will influence the success of the implementation of Technology will be the type of technology taught in the classroom.

The majority of the respondents' answers to question 3 indicated that they felt that appropriate technology will serve South Africa best, provided that:

- the type of technology needs to relate to the community it serves, and
- the relationship of Technology with the community and industry be strongly stressed.

One respondent, although agreeing that appropriate technology is suitable, indicated the misconception surrounding the concepts *low*, *appropriate* and *high technologies*. Low technology is perceived to be cheap and high technology expensive. The respondent said that this is not the case.

- The application of technology must progress from low to high technology as schools develop.

Another respondent indicated that all three types of technology would serve South African schools best.

The responses to question 7 indicated that the respondents felt strongly not to shift the goal posts, because of its dynamic nature. The respondents said that:

- Any technology does not pin you down to specifics.
- Technological capabilities (design, make and evaluate) can apply in any context.
- It can accelerate the narrowing of the gap between the 'haves' and the 'have nots'.

The response to these questions indicates that they largely favour appropriate technology. Technology is also seen as an appropriate vehicle for social change.

Questions 4, 5 and 6 deal specifically with educator motivation, readiness and government assistance in implementing Technology successfully.

- 4. ... do you think we as teachers are well prepared and equipped to implement Technology successfully in the classroom? Elaborate.**
- 5. Do you think that enough has been done by the Department of Education in terms of teacher training? What impact will this have on the implementation of Technology in the classroom?**
- 6. Do you think the level of motivation of teachers at this stage can positively contribute to the successful implementation of Technology in the classroom?**

The following represents the results of the respondents' answers.

Educators are a key constituency in a curriculum design process. The success of implementation largely depends on the level of interaction with the practitioner, i.e. the educator. Their readiness and levels of motivation are very important for the successful implementation of the curriculum. Government support in terms of resources and training is also essential in order to ensure success.

The majority of the responses to question 4 as listed below, indicate that educators are not ready to implement Technology successfully.

- Physical resources are a huge problem.
- The old mindset of teaching is still a problem.
- There is a lack of knowledge.
- It is working in a few provinces only.
- Knowledge and skills are inadequate.
- Educators still have much to learn.

The majority of the responses to question 5 also indicated that educators are not well trained. This deficiency is attributed to the following:

- Initial training problems are experienced, such as which system of training is the best.
- There is a lack of funds for training of educators.
- Financial constraints prevent sustainability of training programmes.
- The diverse interpretation of Technology has also become a stumbling block.
- Fifteen hours is not enough time to train educators.
- The negative attitude of educators toward the new education system also plays a role.

Regarding question 6, the respondents also felt that the educators are not motivated enough to implement Technology successfully.

- Motivation is very low (90%).
- There are no incentives for educators.

- There is neither job security nor opportunity.

The response shows that critical issues such as motivation, resources and training for educators, persist in being a stumbling block for the successful implementation of Technology.

2.2.2 General deductions

The following deductions are made from the results of the interview:

- The respondents have a clear understanding of Technology as a learning area;
- they regard Appropriate Technology as the most suitable for the South African situation; but
- they consider critical issues such as motivation, resources, and training of educators, as still lagging far behind.

The following section, 2.3, deals with the responses to the questionnaires.

2.3 QUESTIONNAIRE

2.3.1. Questions and results

The interviews conducted involved only five persons who had participated in the training of educators. The questionnaire drew information from a broader spectrum of educators who had first-hand experience of the implementation of Technology in the classroom.

This section starts with a summary of the response to the questionnaire. The questionnaire itself consists of three sections: A, B and C.

Section A focuses on the details of the school and the Technology coordinator.

Section B consists of 10 questions, which focus on the implementation of Technology. Questions 1-4 test the understanding of Technology by the respondents. Questions 5 and 6 deal with the type of technology suitable for South Africa and questions 7-10 focus on government support to implement Technology in the schools successfully. (See Appendix C.)

Section C focuses on the positive and negative aspects of technology, and recommendations to improve the situation.

The following table indicates the response to the questionnaire:

	Sent out	Responded	Terminated programme	Non-response
Amount	20	8	5	7
Percentage	100 %	40 %	25 %	35 %

Of the 20 schools, 40% responded with a completed questionnaire. Two schools indicated that the programme had been suspended.

After a second attempt was made by telephone to get more responses, three schools indicated that they had terminated their programmes.

This study views schools that have terminated their programmes as positive respondents. It indicates a particular result hence it is included as a positive response. The failure to implement Technology in these schools is commonly due to a lack of resources and a lack of suitable educators, according to principals. It indicates the difficulty schools experienced in implementing this learning area. The non-respondents will thus constitute 35% and the positive respondents 65% of the total number of questionnaires.

The following is a summary of the results of the three sections of the questionnaire:

SECTION A: BIOGRAPHICAL INFORMATION

The following are statements put to the participants, as well as tables of responses:

1. Number of learners

Above 300	Below 300
4 schools	4 schools
50 %	50%

2. Language

English	Afrikaans	Xhosa
4 schools	3 schools	1 school
50 %	37,5 %	12,5 %

3. Present involvement

Actively involved	Involved
3 schools	5 schools
37,5 %	62,5 %

4. Gender

Male	Female
50%	50%

5. Teaching experience

Above 10 yrs	Between 5-10 yrs	Below 5 yrs
6 educators	1 educator	1 educator
75 %	12,5 %	12,5 %

6. Your attitude towards Technology

Positive	Negative	Neutral
87,5 %	0 %	12,5 %

The data gathered indicates that there are a fair amount of learners that participate in the Technology programme. It also shows that there is a greater incidence of Technology in the English classrooms than in those of the other two languages. The gender participation in the Technology classroom was equal. Most of the educators have more than ten years teaching experience; however, it does not indicate experience in the teaching of Technology. The study also shows that the majority of respondents were very positive about the introduction of Technology as a learning area in the schools.

SECTION B: STATEMENTS ABOUT THE IMPLEMENTATION OF TECHNOLOGY

Statements were put to the participants regarding the implementation of Technology as learning area. Each statement has a scale of 1 (agree), 2 (can't decide), 3 (disagree), and 4 (don't know).

Statements put to the participants:

- 1. Technology is mostly about computers.
- 5. Technology is about satisfying human needs and wants.
- 6. Technology education helps learners develop lively, enquiring minds, the ability to question and argue rationally and the ability to apply themselves to tasks and physical skills.
- 7. Technology education helps learners acquire knowledge and skills relevant to adult life and employment in a rapidly changing world.

The following table indicates the extent to which the respondents have an understanding of Technology.

	Agree	Can't decide	Disagree	Don't know
Statement 1	0	0	8	0
Statement 2	8	0	0	0
Statement 3	7	0	1	0
Statement 4	8	0	0	0

The four statements primarily describe the features of Technology. The respondents overwhelmingly recognized and understood what Technology is.

Statements 5 and 6 refer to empowerment and relevance of technology, which relates to the type of technology under investigation.

Statements put to the participants:

- 8. The aim of Technology is to empower people at a local level to become more productive and to earn a living that will be sustainable.
- 9. Technology helps learners to understand the world in which they live, i.e. interdependence of individuals, groups, nature, nations and the earth.

The following table indicates their responses.

	Agree	Can't decide	Disagree	Don't know
Statement 5	7	1	0	0
Statement 6	6	2	0	0

The majority of the respondents (87%) agree that Technology has to empower people and that Technology must help learners to understand the world in which they live. The understanding of these factors relates closely to the type of technology needed in a South African context.

The following four statements assess the extent to which government is supporting the implementation of Technology in schools.

Statements put to the participants:

- 10. Schools are generally ready to implement Technology.
- 11. Schools are well equipped to implement Technology.
- 12. Our teachers are well trained to teach Technology in the classroom.
- 13. Teachers are well motivated to teach Technology.

The following table indicates the response.

	Agree	Can't decide	Disagree	Don't know
Statement 7	0	2	5	1
Statement 8	0	0	6	2
Statement 9	1	1	6	0
Statement 10	2	0	5	1

The data gathered from these questions indicates the following:

- The participants (62,5%) do not agree that schools are ready to implement Technology in the classroom.
- They disagree that schools are well equipped.
- They also disagree that educators are well trained and motivated to teach Technology in the classroom.

These results indicate that there is a great deal of dissatisfaction in the manner in which the implementation of Technology is being supported.

SECTION C: OPEN-END QUESTIONS ABOUT THE IMPLEMENTATION OF TECHNOLOGY

Section C evaluates what the educators experienced as negative aspects and positive aspects and what they would recommend to facilitate the successful implementation of Technology in schools.

Questions asked:

1. With the implementation of this project, what did you and your colleagues experience as positive?
2. With the implementation of this project, what did you and your colleagues experience as negative?
3. What recommendations would you make to ensure the successful implementation of Technology education as a learning area in all schools?

Question 1 deals with the positive aspects of Technology. The following are the responses:

1. Educators experience great enthusiasm amongst both the learners and the educators in general.
2. Technology allows for flexibility within the content of the subject.

3. The educators appreciate the learning skills developed through Technology by the learners.
4. Technology is a subject that is not gender specific. Both girls and boys can participate in the activities.
5. Technology is viewed as the subject of the future.
6. Technology allows the learners to bring their creative and problem solving abilities to the fore.
7. One respondent was unable to respond because of a lack of experience and modification to the project.

The data indicates that the introduction of Technology in the school is generally positively experienced by the respondents in this survey.

Question 2 focuses on the negative aspects of Technology and the following are the responses:

1. Large classes (number of learners) have become problematic.
2. The government is not doing enough to ensure success in the implementation of the subject.
3. Resources are also a point of concern.
4. Inadequate time, insufficient and improper material, insufficient room to do Technology as well as a lack of training by educators, are wide-spread problems.
5. Standards are questioned.
6. Timetable problems may result in forced projects. (It is not clear what the respondent suggested by this statement)

The nature of these results points to the lack of support services by government to facilitate the successful implementation of Technology.

Question 3 recorded the recommendations made by the educators:

1. More training is needed for educators.
2. Sufficient classroom accommodation must be provided.
3. Technology needs to be implemented in all schools.
4. The use of recycled material should be considered, if there are financial constraints.

The recommendations highlight the need for physical resources and support services from the Department of Education to ensure success with the implementation of Technology.

The evaluation of the responses in Section C indicates a general enthusiasm for the introduction of Technology; however, it also highlights serious implementation problems.

2.3.2 General deductions

The information gathered from the results from the questionnaire lead to the following deductions:

- The respondents do have a conceptual understanding of Technology in the classroom.

- They do understand that the appropriate technology needs to apply to the South African situation. They also experience the introduction of Technology as a very positive step.
- They do not, however, appreciate the lack of government support in terms of training and other resources.

2.4 INTERPRETATION AND GENERAL FINDINGS

Within the context of the three fundamental issues dealt with in this study, the following deductions can be made:

The responses of the participants in the interviews and questionnaires showed that they do have a high level of understanding of what Technology education is. It also clearly showed that the appropriateness of the technology used in schools is critical. The technology has to be relevant in the context in which it is used, i.e. rural, semi-urban, urban or otherwise.

The issue of government support is the most problematic. The Department of Education, according to the participants in this study, is lacking grossly in providing physical resources to schools, and training and retraining to educators. These two factors will largely determine whether the implementation of Technology will succeed, because they affect the educator, who is critical to the success of the learning area.

It can be deduced, within the context of this survey, that the educators are not yet ready to implement Technology successfully.

REFERENCES

- Anderson, G. (1990) **Fundamentals of Educational Research**. London: The Falmer Press.
- Baadjies, B.S. (1997) **'n Prinsipiele Verantwoording van Tegnologie - Onderwys in die Skoolkurrikulum**. MEd. Tesis (Ongepubliseerd), Universiteit van Stellenbosch, Stellenbosch.
- Bell, J. (1993) **Doing Your Research Project: A Guide for First-Time Researchers in Education and Social Science**. Second edition. Buckingham, Philadelphia: Open University Press.
- Burgess, R. G. (1994) **The Research Process in Educational Settings: Ten Case Studies**. London and New York: The Falmer Press.
- Cohen, L and Manion, L. (1995) **Research Methods in Education**. Fourth edition. London: Routledge.
- De Wet, J.J., De Monteith, J.L. Steyn, H.S. & Venter, P.A. (1981) **Navorsingsmetodes in die Opvoedkunde: 'n Inleiding tot Empiriese Navorsing**. Durban & Pretoria: Butterworth en koe (SA) (Edms) Bpk.

Hattingh, C.R. (1996) **'n Funksioneel - Konseptuele model vir Kurrikulumsdisseminasie en Kurrikulumimplementering.**

DEd. proefskrif (Ongepubliseerd), Universiteit van Stellenbosch, Stellenbosch.

Johannes, D. (2000) **Kritiese Elemente in die opvoeding van Onderwysers ten opsigte van Opvoeding vir Vrede.** PhD. proefskrif (Ongepubliseerd), Universiteit van Stellenbosch, Stellenbosch.

McMillan, J.H. & Schumacher, S. (1993) **Research in Education - A Conceptual Introduction.** Third Edition New York: Harper Collins College Publishers.

CHAPTER 3: TECHNOLOGY EDUCATION AS PART OF AN OUTCOMES-BASED CURRICULUM 2005

3.1 INTRODUCTION

This chapter describes Technology as part of an Outcomes-Based Curriculum 2005. It investigates the relevance and purpose of Technology as learning area in the new curriculum.

The political transition in South Africa has propelled us into the global arena, exposing us to pressures and challenges that require innovative and flexible responses to a rapidly changing global environment (Department of Arts, Culture, Science and Technology, 1996:5). The global environment refers to increasing global economic competitiveness, the dawning of the information revolution and increasing new communications technologies. Successful countries and societies are built on the manipulation of these systems. The challenge for South Africa is how to integrate these global systems successfully while dealing with local needs and aspirations.

One of the most important instruments in creating these innovative and flexible capabilities is technological innovations, the driving force behind all successful modern economies. The White Paper on Science and Technology (1991:6) considers Technology to be central in creating wealth and improving the quality of life in contemporary societies. The Organization for Economic Co-operation and Development (OECD) Ministerial meeting in June 1990, agreed that technological change was

a fundamental source of economic growth and social development in the OECD economies.

How does South Africa prepare for these challenges?

South Africa needs an increasingly technological innovation as a broad initiative. This initiative needs to translate into the development of citizens to become technologically literate, a crucial foundation on which to build the economy in particular while contributing to social development generally.

Through its educational institutions and other stakeholders, the country needs to invest in developing "a competent and flexible work force, one that can acquire new skills as economies change," which "is a necessary prerequisite for economic and social development." (A World Bank Policy Paper, 1991:19).

According to Pretorius and Lemmer (1998:viii), this competency and flexibility is measured against the acquiring of good communication, interpersonal and problem solving skills; the ability to learn independently; the ability to think critically and creatively; to be adaptable within a work environment and to function well within a team. It must be complemented with the ability to maintain high educational standards, the ability to keep pace with technological developments, adapt in a relevant way to changes required in the world of work and succeed in building a dynamic corps of skilled workers.

In order for South Africa to meet these challenges, a lot of work still needs to be done.

It is well known that black South African education in particular is inequitable, of low quality and inefficient in delivering quality education (Chetty, 1992:3). Educational problems such as the provision of equal access to schools, equal educational opportunities, irrelevant curricula, inadequate finance, inadequate facilities, shortage of educational materials, the enrolment explosion (post 1990) and inadequately qualified teaching staff all contributed to the current crisis in education in South Africa (Van der Horst and McDonald 1997:5). South Africa's economic competitiveness in the global arena, which depends on how effectively the education system can redress the problems mentioned, still lags behind. In a World Competitiveness Report, according to Pretorius and Lemmer (1998:122) South Africa ranks 40, 47 and 40 out of 48 respectively, with regard to teaching of Science and Technology in schools, adequacy of the education system and the human development index (i.e. literacy).

This scenario set the scene for this study to explore the relevance and purpose of Technology as a learning area in the new curriculum. The aim is to discuss the new learning area Technology as part of the Outcomes-Based Curriculum 2005. It will, in particular, focus on how the introduction of Technology can contribute to the transformation of the economy in particular and society at large.

This chapter, in the first instance, will unpack the concept of Outcomes-Based Education as the new educational approach. It will discuss the

development of outcomes-based education till its general implementation in 1998 and beyond. It will also discuss the essence of outcomes-Based education in terms of the basic principles, features and key elements of this educational approach. It will subsequently define an Outcome, deal with the aims and objectives and lastly explain the Critical Outcomes contained in the new curriculum.

Secondly, it will focus on Curriculum 2005. The essence of Curriculum 2005 will be discussed. It will discuss the aims and objectives, definition, and important features of the new curriculum; the eight learning areas; Specific and Critical outcomes; the curriculum framework (e.g. NQF, Rationale, Assessment Criteria) and key principles of the curriculum.

This chapter will then deal with Technology as a new learning area. It will discuss Technology on two levels. The first level concerns the importance of Technology in contemporary society. The second level concerns the importance of Technology as learning area in the new curriculum. It will discuss the historical developments of Technology within the curriculum and also reflect on the definition, technological process, aims and the specific outcomes of Technology.

In its conclusion, this chapter seeks to emphasize the importance of technological innovation, which enhances economic growth and social development. The new curriculum needs to develop technological literacy within learners. It would suggest that Technology, therefore, has to feature strongly in the new curriculum.

3.2 IMPLEMENTING OUTCOMES-BASED EDUCATION (OBE): A BRIEF OVERVIEW

3.2.1 Current developments

Taking into account the pressures of globalization and the irrelevance of the old traditional system of education, it became clear that the transformation of the South African education system was essential.

The introduction of Outcomes-Based Education was seen as an appropriate educational model to face the challenges of contemporary South Africa. Outcomes-Based Education is a radical shift away from the traditional content-based education system.

Fundamental to Outcomes-Based Education is:

1. the focus on the desired end results of each learning process, and
2. a focus on the instructive and learning processes that will guide the learners to these results (Van der Horst and McDonald, 1997:7).

These two fundamental issues indicate that Outcomes-Based education is learner-centered and result-orientated.

It is important at this stage to give an account of developments that led to the introduction of Outcomes-Based Education. It will focus on the period before the implementation of Outcomes-Based Education and

also discuss policies that were introduced to implement the new approach.

According to Jansen (1999:14) the introduction of Outcomes-Based Education as a new educational approach was influenced by a number of factors, such as the competency debate in labour, the Spady version of Outcomes-Based Education in the United States the apartheid legacy, managing the contradictory claims of reconstruction, redistribution and reconciliation; performance-based learning and the globalization pressures to participate meaningfully in competitive economies.

He gives an overview of these major forces that influenced education and ultimately led to the implementation of Outcomes-Based Education. An important observation that he makes was that the concept Outcomes-Based Education was never discussed, until 1996, as an option for the new dispensation.

The year 1990 was seen as a turning point in the educational policy debate in South Africa. In this year the political landscape changed rapidly. These radical changes set the scene for a democratic South Africa in 1994 and an inevitable transition of the educational system. A number of interest groups joined the education policy debate in anticipation of a new educational system. They were:

1. The National Education Co-ordinating Committee (NECC) which initiated the National Education Policy Investigation (NEPI) to develop education policy for the broad democratic movement. It was to develop a framework for a democratic education system after apartheid. This framework eventually emphasized "... non-racism, nonsexism, democracy, equality and redress as the platform for post-apartheid education policy" (Jansen, 1999:4).
2. The private sector, which created the Private Sector Education Council (PRISEC). This council called for "... more vocational and entrepreneurial education, given the demands of the economy" (Jansen, 1999:5).
3. The foreign-funded United States Agency for International Development (USAID) which put forward curricula that emphasize "... adult education, early childhood education, matriculation preparation programmes ... " (Jansen, 1999:5).
4. The government at that time also proposed alternatives to the existing education system. They published the Education Renewal Strategy (ERS) and A New Curriculum Model for South Africa (CUMSA). These documents stress the need to reduce the number of syllabi to core learning areas, and a stronger emphasis on vocational education. They also stress a stronger "... linkage of education to economic development through an emphasis on science and technology education" (Jansen 1999:5,6).

The important observation, according to Jansen, is that Outcomes-Based Education was never mentioned throughout these proposals until 1996 where "... a key document emerged spelling out the proposal for Outcomes-Based Education" (Jansen, 1999:7).

The main contributor to what was later called Outcomes-Based Education was the revised report of the National Training Board (NTB) through a document called the National Training Strategy Initiative (NTSI). This document proposed an integrated approach to education and training. This proposal later gave birth to the National Qualifications Framework, which will subsequently be discussed in this chapter.

The period of December 1995 to March 1997 saw the establishment of Outcomes-Based Education as a national education approach. The Department of Education published a number of reports which include A Curriculum Framework for General and Further Education and Training (December 1995), Lifelong Learning through a National Qualifications Framework (February 1996), A National Qualifications Framework (NQF) (1996) and Curriculum 2005: Lifelong Learning for the Twenty-First Century (April 1997). Added to the reports was the launch of the South African Qualifications Authority (SAQA) in August 1997, which included discussions regarding the NQF that followed thereafter (Jansen, 1999:39). These reports confirmed the introduction of Outcomes-Based Education and introduced a radical shift from the old traditional education system to a new outcomes-based education system.

The development of the new curriculum since its implementation in 1998 was the establishment of a Review Committee on C2005 by the Minister of Education on the 8 February 2000. The brief, as presented in the

Draft Revised National Curriculum Statement Grade R-9 (Schools) (30 July 2002) of this committee was to review the structure and design of the curriculum, teacher orientation, training and development, learning support materials, provincial support to teachers in schools and implementation time-frames. The recommendations from this report released on 31 May 2000 was the following:

- Reduction of the curriculum design features from eight till three, i.e. critical and developmental outcomes, learning outcomes and assessment standards.
- It should align curriculum and assessment.
- Implementation should be strengthened by improving teacher orientation and training, learning support materials and provincial support; and
- The relaxation of time-frames for implementation (2000:5).

These recommendation were captured in a final draft of the Revised National Curriculum Statement Grades R-9 on 15 February 2002.

3.2.2 The implementation of OBE

The ensuing paragraphs deal with the essence of Outcomes-Based Education and the implementation thereof.

Spady (as quoted by Pretorius,1998:ix) describes an outcome as a demonstration of learning that occurs at the end of a learning experience. Outcomes-Based Education in essence means "education that is based on a framework of Outcomes" (Spady and Schlebusch, 1999:38). This implies that education in terms of planning, teaching, testing, record keeping and reporting are defined and focused

on outcomes. Spady and Schlebusch (1999:37-50) identify several key principles in understanding the meaning of an education system based on outcomes. They are:

1. Outcomes count

The outcome is the most important issue for a learner within his/her learning experience. Identifying an outcome means that it is given special attention in accomplishing it successfully. It is therefore the focus of the instructional process.

2. Outcomes are future-oriented

This implies that outcomes are relevant even after the learner has left formal schooling. The new curriculum identified 12 Critical Outcomes necessary for learners to have accomplished or demonstrated by the end of their formal schooling. The accomplishment of these outcomes enable the learner to engage in active, responsible citizenship, entrepreneurship and continuous learning. These Critical Outcomes will be discussed in the paragraphs that follow.

3. Outcomes happen

The dictionary refers to an outcome as a result. A result can only be identified in a practical activity or observable action. An action or activity requires some skill or competence, which suggests that a learner needs to do or demonstrate (perform) the outcome.

4. Outcomes happen at the end

This refers to a demonstration of an outcome at the end of a learning process. It is the ability of learners to demonstrate activities after they have gone through incremental learning experiences.

5. Outcomes happen in context

Being a demonstration, outcomes needs to be performed somewhere, i.e. there must be a context. The particular context entails the situation, circumstances, physical surroundings and the challenges the learner will face in executing the outcome.

6. Outcomes are success-oriented

There is no place for mediocrity within an outcomes-based education system. The accomplishment of a demonstration or outcome represents a hundred percent success. This suggests that all learners will be successful.

The following can be derived from these key principles:

Key principle 1 indicates that an outcome is the single most important aspect of this educational approach. All other educational activities must be aligned to achieve the desired outcome. Key principle 2 indicates that the aim of an outcome is intended to help the learner in the future. Key principles 3, 4 and 5 indicate that an outcome is an actual demonstration by way of an activity or action. Anything less than an activity or action does not constitute an outcome. It also indicates that an outcome always happens in context, with regard to when, where,

how. Key principle 6 indicates that achieving an outcome creates high expectations from learners, underpinned by the belief that all learners will be successful at the end. An education system based on outcomes, therefore, assumes that all learners can learn, given a clear direction, clear intentions and the conducive environment i.e. time, location, resources. to reach the intended goal.

These definitive principles of what an outcome is, translate into the key features of an education system based on outcomes. According to Van der Horst and McDonald (1997:6) they constitute:

- A focus on the learner;
- Acknowledgement of human diversity;
- A move to participatory, democratic decision making in education;
- An emphasis on accountability;
- The principle of allowing all learners to achieve their full potential;
- A result-orientated approach; and
- The aims of developing a thinking and problem-solving learner.

These features translate into the aims of Outcomes-Based Education which seek to develop a thinking, problem-solving citizen who will be empowered to participate in the development of the country in an active and productive way (Van der Horst and McDonald, 1997:6).

The new curriculum is directed by critical outcomes, which must ensure the accomplishment of the aims of an outcomes-based approach to learning. Critical outcomes are the generic cross-curricular outcomes.

The cross-curricular nature of the outcomes means that it is contained within all eight learning areas in the General Education and Training Band of the new curriculum. The South African Qualifications Authority (SAQA) identified seven critical outcomes and an additional five developmental outcomes. This study will only describe the seven critical outcomes. SAQA proposed that learners would:

- Identify and solve problems and make decisions using critical and creative thinking.
- Work effectively with others as members of a team, group, organization and community.
- Organize and manage themselves and their activities responsibly and effectively.
- Collect, analyze, organize and critically evaluate information.
- Communicate effectively using visual, symbolic, and/or language skills in various modes.
- Use science and technology effectively and critically showing responsibility towards the environment and the health of others.
- Demonstrate an understanding of the world as a set of related systems by recognizing that problem-solving contexts do not exist in isolation.

These critical outcomes identify three important issues. Firstly, the outcomes achieved need to apply in a real world setting. This suggests that there needs to be a strong link between the activity in the classroom and its application in reality. Secondly, learners need to acquire “building blocks” or skills to apply these outcomes in a real-world setting.

Lastly, learners will identify processes and systems to achieve these outcomes successfully.

These Critical Outcomes will ensure that learners gain the skills, knowledge and values that will allow them to contribute to their own success as well as to their family, community and the nation as a whole (DoE, 1997:10). Structures such, as the National Qualifications Framework were set up by government to facilitate the aims of this outcomes-based approach to learning. The National Qualifications Framework (NQF), proclaimed by the South African Qualifications Authority (SAQA), is a set of principles and guidelines by which records of learners' achievements are registered to enable national recognition of acquired skills and knowledge, thereby ensuring an integrated system that encourages life-long learning (Ramphela, 2000:3).

The fundamental principles underpinning the National Qualifications Framework are the focus for integrating education (school) and training (workplace) and providing a framework for lifelong learning. Integration, according to Pretorius (1998:20), forms part of human resources development, which provides for the establishing of a unifying approach to education and training. Education and training are brought together, which will enable learners to move from one place to the other with the least difficulty. The importance of lifelong learning is driven by a rapidly changing world that demands of learners to keep up with new knowledge and technologies. Lifelong learning, therefore, needs a system which will enable individuals at any age to improve his/her qualifications and to be accredited for these improvements in a suitable way (Pretorius and Lemmer, 1998:3).

These two fundamental principles are further supported by the fact that the National Qualifications Framework recognizes prior learning; is accessible and provides a coherent framework of principles and qualifications; allows participation which ensures legitimacy, allows portability; is credible and flexible, ensures standards and promotes progression (Pretorius, 1998:20).

The following is a table which represents the National Qualifications Framework, that subscribes to the principles discussed above.

NQF LEVEL	BAND	QUALIFICATIONS & CERTIFICATES	
8	Higher Education and Training Band	Doctorates and further research degrees	
7		Higher degrees	
6		First degrees and higher diplomas	
5		Diplomas and occupational certificates	
4	Further Education and Training Band	School/College/NGO Certificate (Gr 12)	
3		School/College/NGO certificates	
2		School/College/NGO certificates	
1	General Education and Training Band	Senior phase Grades 7-9	ABET Level 4
		Intermediate phase Grades 4-6	ABET Level 3
		Foundation phase Grades 1-3	ABET Level 2
			ABET Level 1
		Pre-school	

(Van der Horst and McDonald, 1997:75)

To summarise: the National Qualifications Framework, consists of eight qualification levels which are accommodated within three bands, namely the General Education and Training Band (GETB) (from reception year to grade 9, and including four levels of Adult Basic Education and

Training), Further Education and Training Band (FETB) (grades 10-12) and Higher Education and Training Band (HETB) (universities and technikons). The focus will be on the General Education and Training Band as Technology, which is the focus of this study, is one of eight compulsory learning areas in this band. The General Education and Training Band consists of three phases, namely the Foundation phase, the Intermediate phase, and the Senior phase. It also includes Adult Basic Education and Training (ABET levels 1-4).

The underlying thinking behind the creation of a new curriculum, according to Spady and Schlebusch (1999:55), was the need to:

- train learners with regard to new basics to cope with the challenges of the millennium;
- use cheap resources to accommodate resource-poor schools, which constitute the majority of schools in the country;
- create a system that will facilitate unity with regard to a common educational vision in addressing the core social and moral issues of our society;
- integrate the existing teaching corps successfully into the new system of education;
- facilitate the integration of education (school) and training (workplace) and
- develop a system that makes education or learning relevant and that can be applied in a different context by the learner.

These key aspects translated into the creation of a curriculum that seeks to develop learners to be context and performance-oriented in nature.

This, therefore, culminates in Curriculum 2005 that seeks to "... provide children with opportunities to develop to their full potential as active, responsible and fulfilled citizens who can play a constructive role in a democratic, non-racist and equitable society" (DoE, 1997:4).

The necessary skills, knowledge and values will be obtained, and this structure will be implemented, through the eight learning areas in the General Education and Training Band. The learning areas are Language, Literacy and Communication; Human and Social Sciences; Technology; Natural Sciences; Arts and Culture; Mathematical Literacy, Mathematics and Mathematical Sciences; Economics and Management Sciences and Life Orientation (DoE, 1997:8). These learning areas form part of the General Education and Training Band. Technology, as mentioned, forms part of the new curriculum.

The Foundation phase includes grades 1, 2, and 3. The Phase organizers, which represent different learning areas contained in this phase, are Literacy, Numeracy and Lifeskills. The Intermediate phase includes grades 4, 5, and 6. Phase organizers for these grades are drawn from the above-mentioned learning areas, which needs to translate into the understanding of relationships between events, people and materials. The senior phase includes grade 7, 8 and 9. The completion of grade 9 is a formal exit point and indicates the end of formal schooling for learners. All eight learning areas will also have to be completed in this grade. Learners will have to demonstrate that they are ready for life after school, with regard to career, further learning, entrepreneurial opportunities and their responsibilities as citizens in a

democratic society. The General Education and Training Band is a compulsory phase for all learners of school-going age.

3.2.3 Technology and the new curriculum

Within the context of this new curriculum the following paragraphs will discuss Technology as a learning area as part of this Outcomes-Based curriculum.

Technology was implemented in 1998 and formed part of the eight above-mentioned compulsory learning areas contained in the General Education and Training Band of the National Qualifications Framework. Technology has never before been part of the curriculum. Its relevance and value will be discussed in the ensuing paragraphs.

The debate around the inclusion of Technology in the school curriculum started in the early nineties. A document called a Curriculum Model for South Africa (CUMSA) published in 1992, included Technology as a school subject. CUMSA advocated Technology as a separate subject, whilst the Centre for Education Policy Development (CEPD) propagated an integrated Science and Technology format within the curriculum. Eventually the Heads of Education Department Committee (HEDCOM) decided in 1994 to set up a pilot project to trial the introduction of Technology as a new learning area (as quoted in CENIS, 1999:2). These developments ultimately led to the inclusion and implementation of Technology as one of the eight learning areas in the new Outcomes-Based Curriculum 2005.

Successful modern economies largely depend on the degree of technological advancement. Le Roux (as quoted by Baadjies, 1997:84) concurs that economic growth is determined by "... die ontwikkeling van algemene tegnologie ...". It is generally acknowledged that technology is the driving force behind these types of economies. In the White Paper on Science and Technology (WPST) (1996:ii) Mabandla concurs that the " adoption and mastery of technologies will assist us in becoming a competitive nation". And "... technology is considered to be central to creating wealth and improving the quality of life in contemporary society" (WPST, 1996:6). Therefore, a country such as South Africa that pursues well-being and prosperity can no longer treat technological innovation as an option. It has become a crucial survival issue. The South African Minister of Education recognized the importance of Technology education in the White Paper on Education and Training (14 October 1996). The White Paper confirmed that successful modern economies and societies require citizens with a strong foundation on general education, the desire and ability to continue to learn, to adapt to and develop new knowledge, skills, and technologies, to move flexibly between occupations, to take responsibility for personal performance, to set and achieve high standards, and to work co-operatively (Van Dyk and Van Dyk, 1997:1). These characteristics, which are desirable in the modern citizen, which suggest that, ideally, a strong link should exist between education and the demands of the economy. This will lead to the sustainable social development of the country as a whole. The need for technological literacy, therefore, becomes a priority, and is essential to reaching economic success, international competitiveness and sustainable

social development. The relevance and value of Technology as a learning area in the new curriculum, therefore, cannot be questioned.

The nature of Technology, which will be discussed in the following paragraph, will confirm its relevance and value in the new curriculum.

The nature of Technology is contained in its Technological process. According to Van Dyk and Van Dyk (1997:20) the central aspect of Technology is the technological process. The essence of technology is the interaction between hand and mind, thinking and doing. The relationship between these two elements is reflected in the technological process and the outcome of the process. The completion of the technological process would have to enable learners to produce a finished product as a tangible result of the original need or problem they have identified. The learner would have compiled a design portfolio that describes the course of the process. This involves identifying the need (the original problem) and taking it through all the subsequent (intermediate) processes to the eventual evaluation of the product.

The application of the technological process results in the making or establishing of relevant products, processes and systems to be used in a particular environment.

The following table describes the technological process:

The technological process	
Needs analysis and description	Identify a need or problem. Write a design brief. Analyze the problem. Draw up specifications.
Design and develop	Do research. Generate ideas. Develop ideas and select the best. Communicate your ideas.
Planning and making	Know how to choose materials, equipment and processes. Work out costs. Making involves quality of construction, accuracy, finish, appearance and safety.
Testing, evaluation and presentation of portfolio	Test, evaluate and present.

(Van Dyk and Van Dyk, 1998:21)

In the light of this, the following paragraphs will try to conceptualize the technological process.

Needs analysis and description

As mentioned before, the essence of technology is to satisfy human needs or wants. Therefore, it's important to identify the specific need or problem. A need or problem could develop because of circumstances or solutions to problems that are no longer satisfactory. Such needs or

problems are experienced in places such as the home, school, industries, business and sport. In identifying the need or problem, a design brief should accurately describe the problem and the action to be taken. The design brief consists of one or two sentences clearly stating what the problem is, written in general terms. It should and not offer solutions to the problems, but clearly state the intended outcome. An example of such a brief is the following:

An elderly woman has difficulty opening and closing the taps in her bathroom, as she no longer has any strength in her hands. Design something that will make it easier for her to open and close the taps (Van Dyk and Van Dyk, 1998:22). The following step is to analyze the problem. Investigate the problem by asking as many questions as possible, list additional information, visit the actual scene and record the findings. Draw up specifications. Specifications are a narrower description of the design brief, which allow for different solutions to the problem.

Design and develop

After the initial analysis and description of the problem, the learner needs to do proper research by way of questionnaires, gathering information, market research, observation, case studies, correspondence, library, computers, and any other feasible means. The research will result in a number of ideas in order to solve the problem. Through consultation and discussion, the learner must choose the best solution to the problem. The final solution is then presented by way of, for example, conversation, freehand drawing, orthographic sketches or computer-aided drawings (Van Dyk and Van Dyk, 1998:25).

Planning and making

The planning and making of the product follow the presentation of the final solution to the problem. Important aspects that are considered are accurate drawings and specifications, timeframes, costs, a checklist or flowchart, quality, appearance, safety, etc.

Testing, evaluation and presentation

At this stage the product is being tested and evaluated. The product needs to fulfil the outcome of the initial problem. The complete work is then presented by way of a model and a detailed portfolio.

The portfolio describes the nature of the technological process. The Technological process serves as a framework within which the Specific Outcomes (Capabilities) of Technology can be achieved. Specific Outcomes are the general skills, ability and values that a learner will be expected to demonstrate in that particular learning area; in this case Technology. A Discussion Document on Curriculum 2005 (1997:84,85) describes the Specific Outcomes of Technology more comprehensively. These include the following:

Learners will be able to

- understand and apply the Technological Process to solve problems and satisfy needs and wants;
- apply a range of technological knowledge and skills ethically and responsibly;
- access, process and use data for technological purposes;
- select and evaluate products and systems;

- demonstrate an understanding of how different societies create and adapt technological solutions to particular problems;
- demonstrate an understanding of the impact of technology; and
- demonstrate an understanding of how technology might reflect different biases, and create responsible and ethical strategies to address them.

The successful demonstration of these outcomes develops in learners the ability

- to solve technological problems by investigating, designing, developing, evaluating and communicating effectively in their own and other languages and by using different modes;
- a fundamental understanding of and ability to apply technological knowledge, skills and values, working as individuals and as group members, in a range of technological contexts; and
- a critical understanding of the interrelationship between technology, society, the economy and the environment.

These capabilities that result from the Specific Outcomes lay the foundation on which to build a technologically literate society.

Technological literacy will ensure greater economic competitiveness which will culminate in greater social prosperity. It is suggested, therefore, that there is a direct link between technology, economic growth and social development. The necessity of including of Technology as a learning area in the new curriculum cannot be disputed. The cross-curricular nature of Technology gives it a unique place in the curriculum, a curriculum that seeks to integrate education and training and promote lifelong learning, through the NQF. This structure

provides a framework to introduce outcomes-based education, adopted as an alternative to the traditional content-based education.

3.3 CONCLUSION

Technology forms an integral part of the new curriculum. Its relevance and value cannot be ignored. The introduction describes the significance of technological innovation and its economic impact globally. The challenge for South Africa is how to broaden the level of technological innovation in order to impact positively on the local economy and the social status of society. Through its educational structures and other stakeholders, South Africa can begin to build a technologically literate society.

The nature of an outcomes-based approach to learning, and the nature of Technology are very similar. Both put strong emphasis on the end result as well as the process. This suggests that Technology is inherently outcomes-based. The features based on outcomes are a prerequisite, as mentioned in the previous paragraphs, for the building of a workforce prepared to face the challenges of modern economies.

The relevance and value of Technology in the curriculum cannot be challenged. In fact it needs to be emphasized more strongly. Technology, in conclusion, can be seen as catalyst for economic growth and social development.

The following chapter examines how a subject such as Technical Drawing and Technology as learning area can be reconciled with the new curriculum. The focus is on the intergration of an existing subject

with the new learning area, which can also serve as a model for other subjects.

REFERENCES

Bell, J. 1993, **Doing your research Project**. Second edition Library of Congress Cataloging - in - Publication Data. VSA.

Department of Education, 1996. **White Paper on Science & Technology, Preparing for the 21st Century**, CTP Book Printers, Cape Town.

Department of Education, 1997. **Curriculum 2005, Discussion Document**, Pretoria. Isaacs, SBA. 2000. The National Qualifications Framework and the Standards Setting, Pretoria.

Department of Education, 2002. **Revised National Curriculum Statement Grades R-9 (Schools)**. Pretoria.

Jansen, J. & Christie, P. 1999. **Changing Curriculum - Studies on Outcomes-Based Education in South Africa**. Kenwyn, Cape Town: Juta & Co, Ltd.

Kelly, A. V. 1989. **The Curriculum: Theory and Practice**. Third edition. London: Paul Chapman Publishing Ltd.

Oliver, C. 1998. **How to educate and train Outcomes-Based Processes, Knowledge and Skills**. Pretoria: J.L. van Schaik Publishers.

Ornstein, A.C. & Hunkins, F. 1993. **Curriculum: foundations, principles, and theory**. Second edition. Boston: Library of Congress Cataloging-in-Publication Data.

ORT-STEP Institute, 1994. **International Survey on Technology Education**, Johannesburg.

Pretorius, F. 1998. **Outcomes-Based Education in South Africa**. Randburg: Hodder & Stoughton.

Pretorius, F. & Lemmer, E. 1998. **South African Education and Training: Transition in a democratic era**. Randburg: Hodder & Stoughton.

Ramphela, M. 2000. **The National Qualifications Framework: An Overview**, Pretoria.

Spady, W. 1994. **Outcomes-based education - critical issues and answers**. Colorado. American Association of School Administrators.

Spady, W. & Schlebusch, A. 1999. **Curriculum 2005 - A guide for Parents**. Cape Town: Tafelberg Publishers Ltd.

Van Dyk, A. & Van Dyk, G. 1998. **Design and Technology in the classroom today - The thinking teacher's guide**. Goodwood: Via Africa.

Van der Horst, H. & McDonald, R. 1997. **OBE Outcomes-Based Education: A teacher's manual**. Pretoria: Kagiso Publishers.

World Bank Policy Paper, 1991. **Vocational and Technical Education and Training**. Washington. Library of Congress Cataloging-in-Publication Data.

CHAPTER 4: RECONCILING TECHNICAL DRAWING AS A SCHOOL SUBJECT WITH TECHNOLOGY AS A LEARNING AREA IN CURRICULUM 2005.

4.1 INTRODUCTION

Chapter four examines the way in which Technical Drawing as a school subject can be reconciled with Technology as a learning area in the new Outcomes-Based Curriculum 2005. According to the Heinemann English Dictionary (1987:904) to reconcile is to bring or come into a state of harmony or agreement. The motivation to include Technical Drawing is to give Technology a practical context. This chapter wants to demonstrate how an “old” subject can intergrate with a new learning area, i.e. Technology. It subsequently wants to show the importance of Technical Drawing as a communication skill in every stage of the Technological process. The integration of the old and the new can serve as an example for other subjects to intergrate with new learning areas.

Chapter four forms part of two other major areas of focus in this portfolio, i.e. the readiness of educators to implement Technology, which is dealt with in chapter two, and a theoretical study of the value and importance of Technology within the new school curriculum, which is dealt with in chapter three. These three areas form the content of this portfolio, which deals with the implementation of Technology as part of the new Outcomes-Based Curriculum 2005.

The content of this chapter consists of the following: It gives an overview of Technical Drawing with regard to its history, the definition of Technical Drawing, Technical Drawing within the interim curriculum and the essence of Technical Drawing with reference to the Technical Design Process. It will discuss the nature of Technology with particular reference to the Technological Process and will ultimately indicate how Technical Drawing can be integrated into the learning area. It will also discuss the new curriculum with reference to the critical and specific outcomes.

4.2 TECHNICAL DRAWING: INTRODUCTION

4.2.1. Introduction

Drawing, according to Spence (1991:11), was used since the earliest of time as a mode of communication. The Egyptian hieroglyphics that were a form of writing through pictures is witness to this. However, technical drawing as we know it today was only used for human benefit since the industrial revolution. It developed along two distinct lines, namely artistic and technical drawing (Giesecke, 1992: 3). Artistic drawing focused on the expression of aesthetic, philosophic and other abstract ideas. Technical drawing represents the design of objects to be built or constructed. Contemporary Technical Drawing, however, is used in different fields for the manufacturing of a range of products.

Drawing, therefore, as a general and broad concept, is primarily an instrument of communication, which over time, developed into particular focus area, namely Technical Drawing. The significance of Technical Drawing, which is the focus of this chapter, is particularly important for

the manner in which it is applied to develop and manufacture products. The next paragraph deals with the definition of Technical Drawing.

4.2.2 Definition

Technical Drawing in its broadest sense is a visual language that communicates ideas through the use of drawings (Luckow, 1994:1). Unlike spoken language that uses symbols, Technical Drawing is a graphical representation of ideas used to convey a message effectively. For example, the use of a detailed floor plan of a dwelling by a contractor for construction on site makes far more sense than a written document of how to build the house. The use of this graphic language, therefore, is motivated by the fact that a drawing is worth a thousand words, which makes it a very effective tool of communication. The manner in which these graphics are presented, requires certain skills. The development of drawing skills, therefore, is critical in gaining access to this visual language.

4.2.3 The nature of Technical Drawing

The nature of Technical Drawing is contained in the Technical Design Process. It highlights the essential character of Technical Drawing. This process involves the development of a product from the stage of an idea to the delivery of the product to the customer and includes the participation of engineers, draught persons and other stakeholders. Spence (1991:13,14) describes the process as follows:

1. Determine a need.

A need is determined as a result of the absence of a product or the improvement of an existing product e.g. a need for a device that assists the elderly to open and close a tap more easily because of

weakness in the arms, or the need to replace copper pipes with plastic in the plumbing industry.

2. Make preliminary sketches.

This is the stage where the engineering design team proposes preliminary sketches and drawings of the product. Generally, several solutions are proposed which enable the client to choose the best of different solutions.

3. Choose the final design.

After the original ideas have been extensively studied and revisions made, the final design is agreed upon. The specifications for the product are written down and funds are provided for the engineering design team to continue their work.

4. Design the product.

This stage of the technical design process is where the product is technically designed on paper. Different types of drawings are produced to present the final product. Drawings such as sketch plans, layout drawings, detail design drawings, assembly drawings and perspective drawings are used. These drawings represent different aspects of the particular product. Developing these drawings involves consultants such as architects, structural engineers, electrical engineers and other specialists.

5. Test the design.

This stage deals with a prototype of the product. Models are made and tested under actual conditions. The results of the tests are given in a final report. Any revision of the product is made as needed.

6. Prepare final engineering drawings.

Final engineering drawings are prepared. They are checked and given final approval. The drawings are released to the product division of the company and the product is made and sold to the consumer (Spence, 1991:13,14).

The following paragraph highlights the essential qualities which are captured within the nature of Technical Drawing. It also seeks to identify common areas between Technical Drawing and Technology.

Technical Drawing is essentially a visual language, which is primarily used to communicate ideas effectively. Drawing skills need to be developed in order to gain access to this visual language.

It is vital in a modern society to develop the ability to access and process huge amounts of information. Technology develops in learners, knowledge and skills to be competent and confident in accessing and working with various forms of information and data. These skills include information gathering, storing, processing, management and communication skills. Technical Drawing would form part of communication skills, essentially to communicate technological ideas and products, effectively.

The application of Technical Drawing is 'need driven' and problem-solving and therefore it always happens in a particular context, i.e. in the context of leisure, home, school or environment.

The Technology Learning Area gives learners the opportunity to gain knowledge and develop skills that enable them to solve problems for the purpose of producing products and processes that satisfy peoples' needs. These developments always take

place in an economic, political, social and an environmental context. The common feature of Technical Drawing and Technology is that it always happens in a particular context.

Technical Drawing is also a creative activity, allowing different solutions to a particular problem or need, confirming its flexible character.

One of the Critical Outcomes contained in the national curriculum seeks to develop learners' problem-solving skills, so that they can apply creative and critical thinking. This is also underscored by the specific outcomes of Technology.

Making Technical Drawings involves role-players such as engineers, draught persons and architects, highlighting the need for the participants in this activity to be able to work in a team.

This is also a Critical Outcome in the national curriculum, which seeks to enable learners to work effectively with others in a team, group, organization and community. This outcome is also included in the Technology Learning Area.

Technical Drawing draws on a range of different learning areas. Knowledge of mathematics, science and verbal communication skills are essential to execute Technical Drawing effectively.

Technology is also inherently cross-curricular in nature, drawing from a range of areas of learning to apply the necessary skills, knowledge and understanding in order to achieve a technological capability.

Technical Drawings are mainly used for industrial application, in seeking to develop new products, which confirms its importance to economic

growth. Seeking new ways to communicate graphically is vital for any successful industry. This stresses the dynamic and changing character of Technical Drawing.

Technology is recognized as a major driving force behind successful modern economies, which confirms its relationship with industry. Industry which is constantly seeking new technologies confirms the dynamic and changing nature of Technology as learning area.

The nature of Technical Drawing and its relationship with Technology proved to be comprehensive. Technical Drawing as a visual language can be applied usefully to communicate technological capability task effectively.

The ensuing paragraph discusses the interim syllabus of Technical Drawing in the old curriculum and its relationship with the outcomes of Technology in the new curriculum.

4.2.4. Technical Drawing in the old curriculum

Technical Drawing formed a critical part of the traditional curriculum. Within the secondary school phase it was usually clustered with subjects such as Mathematics, Woodworking, Physical Science, English and Afrikaans.

According to the Interim Syllabus for Technical Drawing for Standard 7 (Grade 9) of the Western Cape Education Department (1995) in this curriculum, the aim of Technical Drawing, was to prepare the child for proper adulthood, to focus primarily on the needs of the child and the

needs of the society. The unique nature of Technical Drawing in the curriculum becomes known through the teaching of aspects such as:

- Graphical design, which focuses on the use of drawings to create new ideas based on the need or the improvement of existing ideas.
- Graphical communication, which focuses on the use of drawings to communicate ideas.
- Visualization, which is an abstract concept that focuses on the development of plane and spatial insight to the learner, e.g. the ability to see when an object is flat or three-dimensional.

From this it is clear that Technical Drawing is more than a mere technical skill, as it is used to solve problems and also to develop the learners' cognitive (thinking) and creative skills and the ability to conceptualize planes and spaces.

Knowledge of and competence in the above-mentioned three aspects produce the following capabilities:

The learner will be able to understand and interpret a drawing.

The learner will be able to interpret certain information derived from the drawing.

The learner will be able to represent his ideas graphically.

These capabilities are captured in the interim syllabus of the old curriculum.

How do these capabilities, develop through Technical Drawing, relate to the broader critical outcomes in the new curriculum which are also contained in the learning area outcomes of Technology?

The first two outcomes of Technical Drawing involve the cognitive ability of the learner, which ties in with two critical outcomes dealing with the ability to identify and solve problems and make decisions using critical and creative thinking. It also deals with the ability to collect, analyze, organize and critically evaluate information. The third outcome of Technical Drawing relates to the critical outcomes in terms of the ability to communicate effectively using visual, symbolic, and/or language skills in various modes. The outcomes of Technical Drawing and Technology confirm a strong relationship between them.

The following paragraphs will consequently deal with the reconciliation of Technical Drawing with Technology. These paragraphs will discuss the technological process and how Technical Drawing can be applied in the technological process.

4.3. THE TECHNOLOGICAL PROCESS

The following concepts which make up the technological process will be discussed, i.e. the needs analysis and description; designing and development; planning and making; testing, evaluation and presentation of a portfolio. The aim is to indicate how Technical Drawing can effectively be applied in these different stages of the technological process. These stages present a framework in which a technology capability task can be performed.

4.3.1. Needs analysis and description

This is a stage that identifies a need or a problem because of the shortage of a product or the need to improve an existing product. This need or problem usually happens in a particular context, e.g. school, agriculture, society, home, sport, business and recreation or leisure. The need or problem will then be written in a design brief. The design brief describes the problem accurately and suggest what could possibly be done to solve it.

Sketches at this stage can be very useful, because it is a quick manner in which to articulate ideas for possible solutions. Freehand sketching is a drawing usually used to communicate ideas effectively. Although measurements and sizes are not accurate, its main function is to indicate proportion, space and shape of a particular product. The actual freehand drawing is made up of a combination of point, lines and planes drawn with equipment such as a pencil, eraser and paper.

4.3.2. Design and development

This stage represents a deeper level of investigation into the need or problem. It must be determined whether there is a market for the product. Research, related to existing products, needs to be done. A number of factors must be taken into account such as entrepreneurial possibilities; drawing up of specifications which include size, function, appearance, materials, cost, safety, environment, durability, manufacturing, ergonomics, shape, cleaning, maintenance, finishing, storage and time available. Specifications need to be determined for the primary and secondary functions of the designed product. Ideas

need to be developed and the best one selected, which is then effectively communicated to the client.

The freehand sketches of the previous stage develop into a stage of instrument drawings. Instrument drawings have four important objectives, namely accuracy, speed, legibility and neatness. Drawing is a form of communication, therefore it needs to be accurate to be effective. Time is money within the industry, therefore speed is important to complete the drawings timeously. As mentioned before, the drawing is a form of communication; drawing therefore must be clear and legible in order to serve its purpose well. There needs to be constant striving towards neatness, because it complements accuracy and legibility. These drawings are usually drawn with instruments. A range of instruments can be applied to develop these drawings, such as a drawing board, scale ruler, compasses, pencil, eraser, templates and T-square. The appropriate method of producing these drawings is by way of a multiview drawing or orthographic projection. A multiview drawing or an orthographic projection is a series of separate views of an object arranged so that each view is related to the others. This drawing method, therefore allows the viewer to see the drawing in its true shape, which makes it possible to calculate other important factors such size, function, appearance, materials and cost.

4.3.3. Planning and making

This stage of the process requires proper and careful planning with regard to time, material, equipment and processes that need to be followed. The proper utilization of time is important to become efficient in the manufacturing of a product. It is also important to identify the

materials that need to be used, the relevant tools and the processes required for the design. The cost of the whole model needs to be estimated. This is followed by the making of working drawings. A working drawing depicts exactly how the product is made. It shows how the various pieces are joined together; it reflects the dimensions of each part and also gives a full description of the finishes. The intention is that someone else should be able to take over the drawings and make the model exactly as the planner would have made it.

This stage involves working drawing, i.e. detail drawing and assembly drawings. Detail drawing is a complete description of a single part of an object. This drawing may include auxiliary views, sections, or any other descriptive forms necessary. It includes dimensions, tolerances, and materials, weight, finish, scale of the drawing and other information needed to describe the part completely. An assembly drawing, on the other hand, is a drawing that shows an object as it will appear when all of its parts are put together. An assembly drawing is used to check detail drawings, to describe how an object functions, to give maintenance instructions, to show general design factors for sales purposes, to show sub-assemblies, or to simplify the assembly process during production. It can be in the form of an orthographic drawing or a pictorial drawing.

4.3.4. Testing, evaluation and presentation of portfolio

At this stage of the technological process the design is completed and ready to be evaluated, tested and presented to the client in the form of a model and portfolio. This stage is particularly important, because it indicates the solution to the initial problem or need, experienced.

Technical drawing can facilitate this final process by the development of pictorial drawings i.e. isometric and perspective drawings. A pictorial drawings shows three views in one drawing; in other words, it is a three-dimensional drawing. Its function is to explain the assembly process. Isometric drawing as an example of the pictorial drawings has the object inclined to the plane of projection. Isometric means equal measurements, because the drawing is drawn along two equal angles. A perspective drawing, on the other hand, is a pictorial drawing that shows the object as the eye sees it when looking from a particular point. For example, when you view an object such as a building, the parts at the far end of your eye appear smaller than the parts closer. If the edge of the building could be extended, they would appear to meet on the horizon. This principle of size diminishing with distance is the basis of perspective drawing. Auxiliary techniques such as colour and shades can be added to make the final presentation of the project more effective.

The nature of Technical Drawing as discussed in 4.2 of this chapter indicates various common areas with Technology. The technological process discussed here shows the application of Technical Drawing in all four stages of the technological process, emphasizing the importance of Technical Drawing as an ideal and effective method of communication within this process.

4.4. CONCLUSION

Can Technical Drawing and Technology reconcile in the new Outcomes-Based curriculum? The investigation within this chapter led to the following conclusions:

In the initial paragraphs it was indicated that drawing is essentially a graphical language used as an instrument to communicate ideas effectively. The development of drawing skills allows access to this graphical language.

During the discussion of the nature of Technical Drawing it highlighted features common to Technical Drawing and Technology. These features are:

- the skill to communicate ideas effectively;
- the development of a learner's creativity, problem-solving and critical thinking abilities;
- An emphasis on the ability of a learner to work within a team;
- Their cross-curricular nature as both draws from a range of different learning areas;
- the direct link of Technical Drawing and Technology to economic growth and ultimately social development.

These features translate into the objectives of Technical Drawings and the outcomes of Technology, which are to a great extent integrated and captured within the new curriculum,

- to communicate effectively by using visual (graphic), mathematical and language skills;
- to identify and solve problems by using creative and critical thinking;

- to work effectively with others in a team, group, organization and community; and
- to develop entrepreneurial capacities.

These features and outcomes common to both Technical Drawing and Technology confirm a comprehensive and integrated relationship between the two learning areas.

Technical Drawing as a visual language, therefore, can be applied usefully to communicate technological capability task effectively as indicated in the discussion of the Technological Process within this chapter.

It can be concluded that Technical Drawing can be reconciled with Technology as learning area in the new curriculum.

REFERENCES

Department of Education, 2001. Technology. Draft Revised National Curriculum Statement for grades R-9 (schools). Pretoria.

Giesecke F.E. 1992. **Principles of Technical Drawing**. New Jersey: Macmillan Publishing Company.

Luckow, J. 1994. **The Technical Drawing Workbook**. Massachusetts: Addison-Westley Publication Company, Mission Hills.

Spence, W.P. 1991. **Drafting Technology and Practice**. Third Edition. California. A Macmillan/McGraw-Hill Company, Mission Hills.

Van Dyk, A & Van Dyk, G. 1998. **Design and Technology in the Classroom Today**. Cape Town: Via Africa.

Western Cape Education Department, 1995. Interim Syllabus for Technical Drawing Ordinary Grade Standard 7. Cape Town.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1. INTRODUCTION

The dawning of a democratic South Africa in 1994 confronted the country with two critical challenges.

Firstly, South Africa had inherited an education system in crisis from the past political dispensation. This system of education simply did not meet the social and economic needs of the new South Africa. Secondly, since becoming part of the international community, the country exposed itself to fierce international economic competition. South Africa, consequently, faced the problem of becoming economically competitive in a global environment. The critical question for South Africa is, how to respond successfully to these two key challenges.

The introduction of an education system based on outcomes is an attempt by government to face these challenges. An outcomes-based education system seeks to develop a learner's creative, critical thinking and problem solving abilities. These qualities enhance the capacity for life long learning. Life long learning is also underscored by the outcomes of Technology, which seeks to develop in learners, problem solving, creative thinking, critical thinking and decision-making abilities. Technological innovation is seen as the driving force behind successful modern economies, thus making it an ideal catalyst for social and economic upliftment.

This research portfolio investigated the implementation of Technology as learning area in the new Outcomes-Based Curriculum 2005, within this context. The investigation was done in three steps, namely an empirical study of the readiness of educators to implement Technology in schools, a theoretical study of the value and importance of Technology within the new curriculum, and a discussion on how a subject such as Technical Drawing from the traditional education system can reconcile with Technology as a new learning area in the new curriculum.

The investigation of these three key areas enabled the researcher to make the following finding with regard to the implementation of Technology.

5.2 FINDINGS OF THE STUDY

Chapter 2 investigated, by means of a questionnaire and interviews, the readiness of educators in selected schools in the Western Cape to implement Technology as learning area. The context of the investigation focused on three issues, namely a conceptual understanding of Technology by educators, the type of Technology relevant to the South African context, and government support to facilitate the implementation of the learning area. The findings are comprehensively dealt with in chapter 2, but can be reduced to three critical issues within the context of the implementation of Technology, namely

- Educators do have a high level of understanding of what Technology education entails.

- Educators have identified the need to implement Technology that is relevant to the local environment, i.e. appropriate technology.
- The biggest problem confronting the successful implementation of Technology in schools, according to educators, is the lack of government support with regard to physical resources, teacher training and retraining and financial support.

Chapter 3 focused on the implementation of Technology as part of an outcomes-based curriculum. The focus was on the relevance and purpose of Technology as learning area in the new curriculum. This investigation led to the following findings:

- Technology forms an unequivocal part of the new curriculum. It has proved to be a driving force behind all successful modern economies.
- South Africa lacks technological literacy.
- Technology has proved to be a catalyst for economic growth and social development.

Chapter 4 dealt with the reconciliation of Technical Drawing and Technology. It found that given the unique nature of Technical Drawing, it could be used as a communication tool within the technological process to achieve a capability task.

5.3 RECOMMENDATIONS

Within the context of the three focus areas of this portfolio, i.e. the readiness of educators to implement Technology as learning area; the importance and relevance of Technology within the curriculum; and the reconciliation of Technical Drawing with Technology, the following recommendations can be made:

- The educators have a high level of understanding of what Technology entails. The Department of Education should capitalize on this development.
- Educators put a strong emphasis on appropriate technologies. The education department, in developing curriculum content, needs to be sensitive to local technologies to avoid alienation of local communities.
- The Department of Education should make a significant contribution in terms of support, i.e. resources, training and retraining of educators.
- Technology should enjoy priority within the curriculum, in view of the fact that technological innovation enhances economic success and contribute to social development.
- The Department of Education should promote and contribute comprehensively to the development of technological literacy to ensure economic competitiveness.

- There is a strong link between technological innovation, economic success and social development. The Department of Education should mediate this relationship clearly to educators in order to consolidate the importance and relevance of Technology within the curriculum.
- Chapter four indicated that the traditional subjects could integrate within the new learning areas in the new curriculum. The Department of Education should provide the educators with a model to ensure a smooth transition from the old to the new.

5.4 CONCLUSION

The focus of this portfolio is on the successful implementation of Technology. The implementation phase in the context of the curriculum design process, plays a critical role in ensuring the success of the curriculum. However, phases such as the curriculum dissemination and curriculum evaluation phases are equally important, to ensure that the implementation phase is successful.

In conclusion, relevance and important of Technology as learning area in the school curriculum cannot be disputed. It has been proven beyond doubt that Technology can be a catalyst for social development and economic growth.

APPENDIX A

LIST OF QUESTIONS USED IN INTERVIEWS

INTERVIEWS

THE IMPLEMENTATION OF TECHNOLOGY EDUCATION

Five people were interviewed.

The names of the interviewees will be replaced by A,B,C,D and F to ensure anonymity agreed to at the time of the interviews.

Interviewees:

A and B

ORT-STEP INSTITUTE

Cape College of Education

Mowbray

18 October 1998

C, D and F

Technology 2005 Task Team

Parow Teachers' Centre

Parow

25 October 1998

QUESTIONS

1. Given your extensive involvement in technology education, give your understanding of technology in particular within the South African context.
2. How do you view the inclusion of technology as a general compulsory learning area within the new curriculum?
3. It is taken that you have an understanding of concepts such as appropriate, low and high technology. What type of technology, in your view, would serve South Africa best?
4. Given the fact that Technology is already included in the new curriculum, and it is now only a matter of implementation, and bearing in mind our educational realities in terms of advantaged and disadvantaged schools, lack of finance and resources, do you think we are well prepared and equipped to implement technology successful in the classroom? Elaborate.
5. Do you think the Department of Education has done enough in terms of teacher training. What impact will this have on the implementation of technology in the classroom?
6. Do you think that the level of motivation of teachers at this stage can positively contribute to the successful implementation of technology? If not, how can one improve the situation?
7. Technology changes very rapidly, resulting in the frequent shifting of the so-called goal posts. Do you think that technology is an appropriate vehicle to empower the masses in the township schools, or at least narrow the gap between the "haves" and the "have nots"?
8. The broad educational aims of the government are to redress the past imbalances and to bring about the equitable distribution of

resources to help in developing the human potential of the population, among other things. Do you think that technology can contribute positively in this instance?

THANK YOU FOR PARTICIPATING IN THIS INTERVIEW

APPENDIX B

LETTER OF PERMISSION TO DISTRIBUTE QUESTIONNAIRE AMONGST SCHOOLS

6 Bronkhorst Street
Parow-Valley
7500
28 September 1998

The Coordinator / Die Koördineerder
Technology Project / Tegnologie Projek

Dear Sir/Madam
Geagte Meneer/Mej/Mevrou

**PROJECT: THE IMPLEMENTATION OF TECHNOLOGY
EDUCATION: A CRITICAL REFLECTION**
**PROJEK: DIE IMPLEMENTERING VAN TEGNOLOGIE
ONDERWYS: 'N KRITIESE REFLEKSIE**

In order to obtain information concerning the above mentioned project I need your help in completing the questionnaire. I am currently studying for a Masters Degree in Curriculum Development with the focus on Technology Education. Your input will help in assessing three critical questions. **Firstly**, the general understanding of technology and technology education in particular within the broad community, school and learner context. **Secondly**, what type of technology education do we need in our schools. And **thirdly**, how prepared are we in implementing technology education in terms of adequately trained teachers, resources, etc.

I will be grateful if you could follow the instructions closely. Please answer the questions as complete and as objectively as possible. Please ensure that you do not omit any questions. All information will be treated confidentially. The questionnaire can be sent back to the address as stated on the prepared enveloped. I would be grateful if you could send the information back within two weeks of receiving the questionnaire.

Om inligting oor bogenoemde projek in te samel benodig ek u hulp met die voltooiing van die vraelys. Huidiglik studeer ek vir 'n Meesters Graad in Kurrikulumkunde met 'n fokus op Tegnologie Onderwys. Die inligting wat versamel word sal my instaat stel om drie belangrike vrae te evalueer. Eerstens, die algemene verstaan van tegnologie en tegnologie onderwys in besonder met verwysing na die breë gemeenskap, skool en leerder. Tweedens, watter tipe tegnologie sou geskik wees vir ons skole. En derdens, hoe gereed is ons vir die implementering van tegnologie onderwys met verwysing na onderwys opleiding, toerusting, ens.

U word asseblief versoek om die vrae so volledig en objektief as moontlik te beantwoord. Maak asseblief seker dat u nie vrae uitlaat nie. Alle inligting sal as vertroulik behandel word. Die vraelyste kan teruggestuur word na die adres soos vermeld op die voorbereide koevert. Ek sal dit waardeer as u die vraelyste kan terugstuur binne twee weke na ontvangs.

Your cooperation is appreciated.
U samewerking word waardeer.

JOHN ADAMS

QUESTIONS / VRAE

The Coordinator / Die Koördineerder
Technology Project / Tegnologie Projek

Name of school:

Naam van skool:

SECTION A / AFDELING A

Indicate with a right mark (✓) in the appropriate square.

Maak asseblief 'n regmerk (✓) in die toepaslike blokkie.

Particulars about the school <i>Besonderhede oor u skool</i>		
Amount of learners <i>Getal leerders</i>	below 300 <i>onder</i> above 300 <i>bo</i>	<input type="checkbox"/> <input type="checkbox"/>
Language <i>Taalmedium</i>	English Afrikaans Xhosa	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Present involvement with the project <i>Huidige betrokkenheid by projek</i>	active / <i>aktief</i> involve / <i>betrokke</i> terminated / <i>gestaak</i>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Particulars about yourself as coordinator <i>Besonderhede oor uself as koördineerder</i>		
Gender / <i>Geslag</i>	male / <i>manlik</i> female / <i>vroulik</i>	<input type="checkbox"/> <input type="checkbox"/>
Teaching experience / <i>Onderwysondervinding</i>	0 - 5 years / <i>jaar</i> 5 - 10 years / <i>jaar</i> + 10 years / <i>jare</i>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Your attitude towards Technology <i>U houding teenoor Tegnologie</i>	Positive / <i>Positief</i> Neutral / <i>Neutraal</i> Negatief / <i>Negative</i>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

SECTION B / AFDELING B

The following are some questions about technology. In answering the question, encircle the appropriate number. *Hier volg 'n paar vrae oor tegnologie. Omsirkel die gepaste nommer met die beantwoording van die vrae.*

	Agree <i>Ja</i>	Can't decide <i>Onbeslis</i>	Disagree <i>Nee</i>	Don't know <i>Weet nie</i>
1. Technology is mostly about computers. <i>Tegnologie is meestal oor rekenaars.</i>	1	2	3	4
2. Technology is about satisfying human needs and wants. <i>Tegnologie is die bevrediging van menslike tekortkominge en begeertes</i>	1	2	3	4
3. The aim of technology is to empower people at a local level to become more productive and to earn a living which will be sustainable. <i>Die doel van tegnologie is die bemagtiging van mense op 'n plaaslike vlak om 'n meer produktief en self-onderhoudende lewe te lei.</i>	1	2	3	4
4. Technology Education help learners develop lively, enquiring minds, the ability to question and argue rationally and to apply themselves to the tasks and physical skills. <i>Tegnologie Onderwys help leerders met die ontwikkeling van lewendige, kritiese denke, die vermoë om vrae te vra en rasioneel te beredeneer en hulself toe te pas met take en fisiese vaardighede.</i>	1	2	3	4
5. Technology Education help learners acquire knowledge and skills relevant to adult life and employment in a fast changing world. <i>Tegnologie Onderwys help leerders kennis en vaardigheid ontwikkel wat toepaslik is vir hul volwasse lewe en die werkplek in 'n vinnige veranderende wêreld.</i>	1	2	3	4

<p>6. Technology Education help learners to understand the world in which they live i.e. interdependence of individuals, groups, nature, nations, earth, etc.</p> <p><i>Tegnologie Onderwys help leerders om die wêreld waarin hul leef beter te verstaan i.e. interafhanklikheid van individue, groepe, die natuur, nasies, die aarde, ens.</i></p>	1	2	3	4
<p>7. Schools are generally ready and prepared to implement technology education.</p> <p><i>Skole is oor die algemeen gereed om tegnologie onderwys te implementeer.</i></p>	1	2	3	4
<p>8. Schools are well equipped to implement technology education.</p> <p><i>Skole is goed toegerus om tegnologie onderwys te implementeer.</i></p>	1	2	3	4
<p>9. Our teachers are well trained to teach technology in the classroom.</p> <p><i>Ons onderwysers is goed opgelei om tegnologie in die klaskamer te onderrig.</i></p>	1	2	3	4
<p>10. Teachers are well motivated to teach technology.</p> <p><i>Onderwysers is goed gemotiveerd om tegnologie te onderwys.</i></p>	1	2	3	4

SECTION C / AFDELING C

Give, to the best of your ability, an honest answer to the following questions about the implementation of Technology as learning area in your school.

Gee asseblief u eerlike mening oor die volgende vrae in verband met die implementering van Tegnologie as leerarea in u skool.

1. With the implementation of this project, what did you and your colleagues experience as **positive**?

*Wat het u en u kollegas as **positief** ervaar met die implementering van die projek?*

2. With the implementation of this project, what did you and your colleagues experience as **negative**?

*Wat het u en u kollegas as **negatief** ervaar met die implementering van die projek?*

3. What recommendations would you make to ensure the successful implementation of Technology as a learning area in all schools?

Watter wenke wil u aanbied om die suksesvolle implementering van Tegnologie as 'n leerarea in alle skole te verseker?

Thank you very much for your time and willingness to complete this questionnaire.

Baie dankie vir u tyd en bereidwilligheid om die vraelys te voltooi.

APPENDIX C

EXAMPLE OF THE QUESTIONNAIRE THAT WAS SENT OUT TO THE SCHOOLS

**Wes-Kaap Onderwysdepartement
Western Cape Education Department
iSebe leMfundo leNtshona Koloni**

Navrae Enquiries Imibuzo	Hennie Mentz	Verwysing Reference Ubhekiso	13/2/10	Telefoon Telephone iMfonomfono	403-6023
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Mr J. Adams
Fax: 933-3181

Kantoor van die
Office of the
i-Offisi ye

Privaatsak
Private Bag

Dorp/Stad
Town/City
iDolophi/iSixeko

Poskode/Postal Code
iKhodi lePosi

Datum/Date
Umhla

Head: Education

9114

CAPE TOWN

8000

Faks
Fax **419-5967**

hmentz@wced.wcape.gov.za

1998-11-04

Dear Mr Adams

Research project: The implementation of Technology Education: a critical reflection

Your application to conduct the above-mentioned research in the approximately 100 schools in the Western Cape piloting the Technology Learning Area has been approved subject to the following conditions:

1. The principals, teachers and learners are under no obligation to assist you in your investigation.
2. The principals, teachers, learners and schools should not be identifiable in any way from the results of the investigation.
3. All arrangements concerning your investigation should be made by you.
4. A photocopy of this letter should be submitted to the principal of each school where the intended research is to be conducted.
5. A brief summary of the content, findings and recommendations should be provided to the Director: Curriculum Management (Research Section).
6. The Department also requires that a copy of the completed report/dissertation/thesis be sent to:

The Director: Curriculum Management
(Research Section)
Western Cape Education Department
Private Bag 9114
CAPE TOWN
8000

We wish you success in your research.

Yours sincerely

Hennie Mewb

pp. HEAD: EDUCATION
